

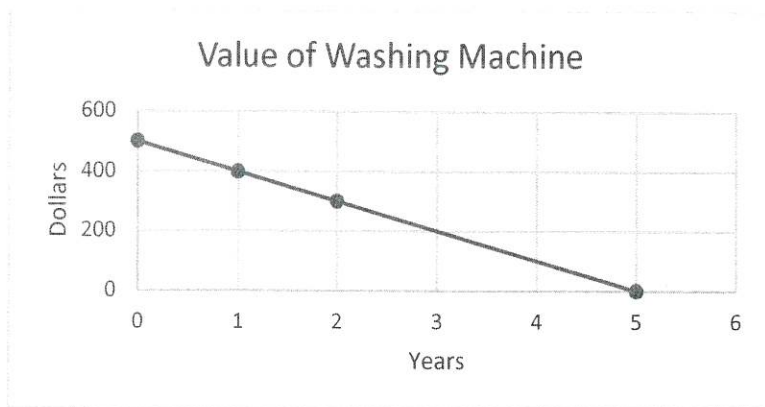
Key

Fall 2022

1

Final Exam Fall 2024:

1) Use the graph to answer the questions:



<14 pts>

a) What is the slope? Include units.

$- \$100/\text{year}$

b) What is the y-intercept and what does it represent?

The initial value of washer is \$500

c) Use the graph to find $f(3)$. Include units.

\$200

d) What is the domain (in interval notation)?

$[0, 5]$

e) What is the range (in interval notation)?

$[0, 500]$

f) What is the x-intercept and what does it represent?

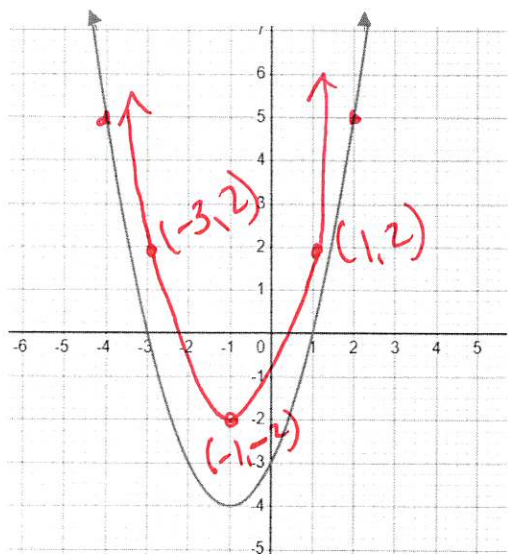
After 5 years, the washer has no value.

g) Write the equation that gives the value of the washing machine after x years.

$y = -100x + 500$
or $y = 500 - 100x$

<15 pts>

2) Use the graph of $y=f(x)$ to answer the questions



a) Give the interval(s) on which $f(x)$ is increasing.

$(-1, \infty)$

b) List the vertex. Is it a max or min?

$(-1, -4)$ MIN

c) List the axis of symmetry

$x = -1$

d) List the range in interval notation.

$[-4, \infty)$

e) State the domain in interval notation.

$(-\infty, \infty)$

f) Find $f(0)$

$= -3$

g) Give the x-value(s) where $f(x)=5$.

$2, -4 = x$

h) Give the interval(s) on which $f(x) \leq 0$

$[-3, 1]$

i) Graph $h(x) = f(x) + 2$ on the same set of axes. Label 3 points on $h(x)$.

3) Wade's grandmother gave him \$100 for his birthday. Wade wants to save his money to buy some headphones. Each month, he adds \$25 to his savings.

<5 pts>

a) Write a function that gives the total amount Wade has after x months.

$f(x) = 100 + 25x$

b) Set up an equation to find the number of months until he had \$250 saved. Do NOT solve.

$100 + 25x = 250$

4) State the domain in interval notation:

<9 pts>

a) $f(x) = \sqrt{x-7}$

$[7, \infty)$

$x-7 \geq 0$

$x \geq 7$

b)

$f(x) = \frac{5}{x+1}$

$(-\infty, -1) \cup (-1, \infty)$

$x \neq -1$

c)

$g(x) = 2x^3 - 4x + 1$

$(-\infty, \infty)$

5) Consider the equation $3x - 5y = 10$

<5 pts>

a) Solve the equation for y

$$\begin{aligned} -5y &= \frac{-3x + 10}{-5} \\ y &= \frac{3}{5}x - 2 \end{aligned}$$

b) State the slope and y-intercept:

Slope:

$$\frac{3}{5}$$

y-intercept:

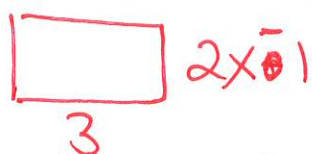
$$(0, -2)$$

6) Consider a rectangle with a length of 3 cm and a width of $2x-1$ cm

<8 pts>

a) Find the area of the rectangle. Include units.

b) Find the perimeter of the rectangle. Include units.



$$\begin{aligned} P &= 3 + 3 + 2x - 1 + 2x - 1 \\ P &= 4x - 4 \text{ cm} \end{aligned}$$

$$\begin{aligned} A &= L \cdot W \\ &= 3(2x - 1) = 6x - 3 \text{ cm}^2 \end{aligned}$$

7) A study found that the yield (in thousands of pounds of vegetables), y, was related to the amount of fertilizer per acre (in hundreds of pounds), x, by $y = -0.3x^2 + 1.08x + 1$

<5 pts>

a) How much fertilizer is needed to maximize yield? Include units. Show work algebraically (no guess and check)

$$x = \frac{-b}{2a} = \frac{-1.08}{2(-0.3)} = 1.8 \text{ hundred pounds}$$

Handwritten notes: yield in thous lbs, fert. in hund pounds

b) What is the maximum yield? Include units.

$$-0.3(1.8)^2 + 1.08(1.8) + 1 = 1.972 \text{ thous. lbs of vegetables.}$$

8) Under each, indicate if it is: linear, quadratic, exponential growth, exponential decay, logarithmic, or another power model (other than linear or quadratic)

<9 pts>

a) $y = 2(0.1)^x$

Answer exp. decay

b) $2x + 3y = 7$

Answer linear

c) $f(x) = 2x^{1.3}$

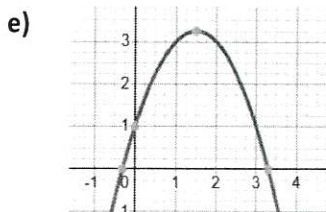
Answer power

d)

x	Y
1	5
2	25
3	125
4	625

Handwritten notes: +1<, +1<, +1<, +1<, x5, x5, x5, x5

Answer exp. growth



Answer quadratic

f)

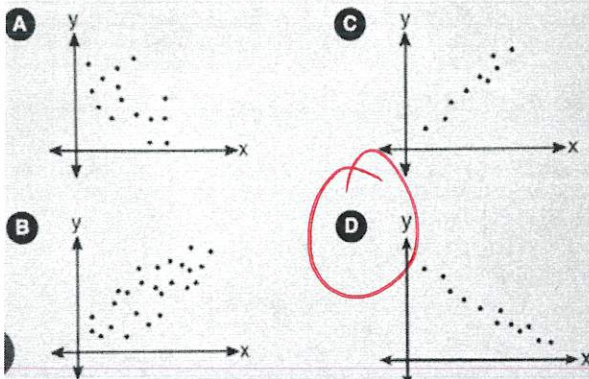
x	Y
1	5
2	10
3	15
4	20

Handwritten notes: +1<, +1<, +1<, +1<, +5, +5, +5, +5

Answer linear

9) <3 pts>

Which graph represents data used in a linear regression that produces a correlation coefficient closest to -1 ?



10) Use the chart to answer the following:

<6 pts>

Dosage Calculation Conversions

1 mg = 1000 mcg
 1 gm (g) = 1000 mg
 1 L = 1000 mL
 1 mL = 1 cc
 5 mL = 1 Tsp
 3 Tsp = 1 Tbsp
 15 mL = 1 Tbsp
 30 mL = 1 oz
 1 oz = 2 Tbsp
 8 oz = 1 cup
 1 kg = 1000 gm (g)
 1 kg = 2.2 lbs

NursingSOS

a) How many milliliters are in 2.8 teaspoons?

$$2.8 \text{ tsp} \cdot \frac{5 \text{ mL}}{1 \text{ tsp}} = \boxed{14 \text{ mL}}$$

b) How many grams (g) are in 200 micrograms (mcg)?

$$200 \text{ mcg} \cdot \frac{1 \text{ mg}}{1000 \text{ mcg}} \cdot \frac{1 \text{ g}}{1000 \text{ mg}} = \frac{200}{1000000} = \boxed{0.0002 \text{ g}}$$

11) Solve algebraically (no guess and check so show all appropriate steps). Round to 2 decimal places if needed.

<20 pts>

a) $5x^2 - 2x - 4 = 0$

$$a=5 \quad b=-2 \quad c=-4$$

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(5)(-4)}}{2(5)}$$

$$= \frac{2 \pm \sqrt{84}}{10}$$

c) $2x^{-2} = 50$

$$\frac{2}{x^2} = 50$$

$$2 = 50x^2$$

$$x^2 = \frac{2}{50}$$

$$x^2 = \frac{1}{25}$$

$$x = \pm \sqrt{\frac{1}{25}}$$

$$\boxed{x = \pm \frac{1}{5}}$$

b)

$$\frac{1}{2}x - \frac{2}{3} = \frac{x}{6} - 5$$

$$3x - 4 = x - 30$$

$$2x = -26$$

$$\boxed{x = -13}$$

d)

$$6x^{1/3} + 4 = 22$$

$$\frac{6x^{1/3}}{6} = \frac{18}{6}$$

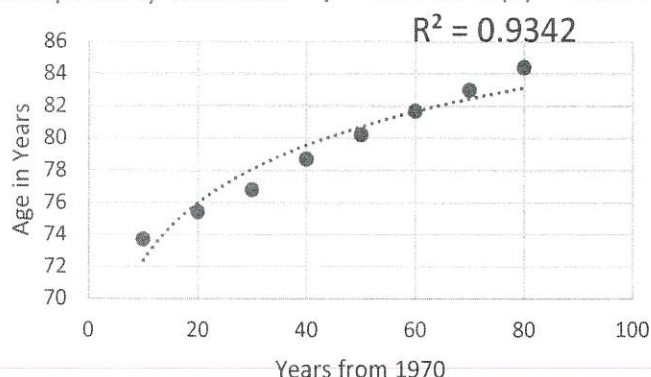
$$x^{1/3} = 3$$

$$(3x)^3 = (3)^3$$

$$\boxed{x = 27}$$

14) Use the graph to answer the following: <10 pts>

Life Expectancy 1980-2050 $y = 5.1785 \ln(x) + 60.449$



a) Does the logarithmic function seem to be a good fit for the data? Why or why not?

yes, r^2 is close to 1.

b) Use the equation of the logarithmic regression model to approximate the life expectancy in the year 2010. Be sure to your answer seems reasonable from the graph. Round to 2 decimal places.

2010 - 1970 = 40.

$$5.1785 \ln(40) + 60.449 = 79.55 \text{ years}$$

c) Suppose instead that we wanted the model to have x be the number of years since 1980. Write the new equation in terms of x .

$$y = 5.1785 \ln(x+10) + 60.449$$

d) Use the equation of the regression model to predict the year in which the life expectancy will be 82. Show all work algebraically, no guess and check. Be sure your answer seems reasonable from graph. Round to nearest year.

$$82 = 5.1785 \ln(x) + 60.449$$

$$-60.449 \quad -60.449$$

$$\frac{21.551}{5.1785} = \frac{5.1785 \ln x}{5.1785}$$

$$x = 64.176 \text{ years}$$

$$\boxed{2035} \leftarrow \text{from 1970 round up!}$$

15) Set up the system, define the variables. **Do NOT solve.** A chemist needs to mix a 10% acid solution with a 30% acid solution to create 100ml of a 20% acid solution. How many ml of each solution should be used?

Define variables and set up system only!

<4 pts>

X = amt (mL) of 10% sol.
 y = amt (mL) of 30% sol.

$$\begin{cases} X + y = 100 \\ .10X + .30y = .20(100) \end{cases}$$

- 16) Find the equation of the line through the points (2,4) and (6,9)

<5 pts>

$$y - y_1 = m(x - x_1)$$

$$y - 4 = \frac{5}{4}(x - 2)$$

$$y - 4 = \frac{5}{4}x - \frac{5}{2} + 4$$

$$y = \frac{5}{4}x + \frac{3}{2}$$

$$m = \frac{9-4}{6-2} = \frac{5}{4}$$

- 17) Write an exponential function for the amount after
- t
- hours if the initial amount of medicine in the system is 200 mg and it is decreasing by 10% per hour.

<3 pts>

1-.10

$$f(x) = 200(.90)^x$$

- 18) Set up and solve the system algebraically:

<5 pts>

The talent show committee sold a total of 530 tickets in advance. Student tickets cost \$3 each and the adult tickets cost \$4 each. If the total receipts were \$1740, how many of each type of ticket were sold? Define the variables and solve algebraically (no guess and check). Write answer in sentence form.

$$\begin{aligned} x &= \# \text{ of student tickets} \\ y &= \# \text{ of adult tickets} \end{aligned}$$

$$\begin{cases} x + y = 530 & (-3) \\ 3x + 4y = 1740 \end{cases}$$

$$-3x - 3y = -1590$$

$$3x + 4y = 1740$$

$$y = 150$$

$$\begin{aligned} x + 150 &= 530 \\ x &= 380 \end{aligned}$$

380 Student tickets
150 Adult tickets

- 19) The cost, in dollars, to produce
- x
- shelving units is
- $C(x) = 10x + 5000$
- . The Revenue generated from the sale of
- x
- units is
- $R(x) = 210x$
- .

<7 pts>

- a) What is the profit function for the sale of
- x
- units?

- b) What is the break even point? Find
- x
- and
- y
- . include units on each.

$$\begin{aligned} P &= R - C \\ &= 210x - (10x + 5000) \\ &= 210x - 10x - 5000 \\ P(x) &= 200x - 5000 \end{aligned}$$

$$\begin{aligned} R &= C \\ 210x &= 10x + 5000 \\ \frac{200x}{200} &= \frac{5000}{200} \quad \left| \begin{array}{l} x = 25 \\ \text{Units} \end{array} \right. \end{aligned}$$

- 20) Factor completely:

<12 pts>

a) $25x^2 - 4$

b) $2x^2 - 2x - 12$

c) $2x^2 + 5x - 12$

$$R(25) = C(25) = 210(25) = 5250$$

$$(5x-2)(5x+2)$$

$$\begin{aligned} 2(x^2 - x - 6) \\ 2(x-3)(x+2) \end{aligned}$$

$$(2x-3)(x+4)$$

- 21) If there are 15 trees in a forest and this represents 12% of the total trees. How many trees are there in the forest? <3 pts>

$$12\% \text{ of } \underline{\quad} = 15 \quad \frac{.12x = 15}{.12} \quad x = \underline{125 \text{ trees}}$$

- 22) If there are 200 trees in a forest and 6% of them are dead and need to be taken down, how many of them need to be taken down? <3 pts>

$$6\% \text{ of } 200 = .06(200) = \boxed{12 \text{ trees}}$$

- 23) If there are 200 trees in the forest and 33% more are planted, how many will there be in all? <3 pts>

$$200 + .33(200) = \boxed{266 \text{ trees}}$$

- 24) If there were 200 trees in a forest and more were planted. After the planting, there were 360 trees. What is the percent increase in trees? <3 pts>

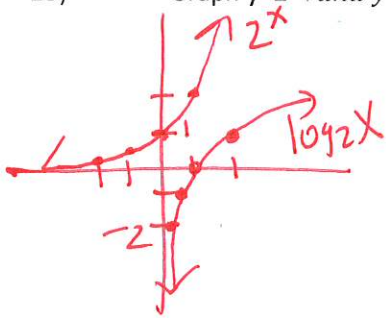
New = old + % of old

$$360 = 200 + x \cdot 200$$

$$\frac{160}{200} = \frac{200x}{200}$$

$$x = .8 \rightarrow \boxed{80\%}$$

- 25) Graph $y = 2^x$ and $y = \log_2 x$ on the same set of axes. Label at least 4 points on each. <5 pts>



x	y = 2^x
-2	2 ⁻² = .25
-1	2 ⁻¹ = .5
0	2 ⁰ = 1
1	2 ¹ = 2

x	y = log ₂ x
.25	-2
.5	-1
1	0
2	1

- 26) Give the equation of the functions: <9 pts>

Switch x & y.

a)

x	-2	-1	0	1	2
y	3	7.5	18.75	46.875	117.1875

exponential

x2.5

x2.5

x2.5

$$y = 18.75(2.5)^x$$

b)

x	0	1	2	3	4
y	4	7	10	13	16

linear

(0,4)
pt.

+3
m = 3/1 = 3

+3

+3

$$y - 4 = 3(x - 0)$$

$$y = 3x + 4$$

- c) There are initially 400 bacteria and the amount triples every day.

$$y = 400(3)^x$$